

U.S. Patent Application Serial No. 10/775,216
Response filed April 28, 2006
Reply to OA dated January 12, 2006

AMENDMENTS TO THE SPECIFICATION:

Amend the specification as follows:

Please replace the paragraph beginning at page 6, line 19, with the following rewritten paragraph:

FIG. 2 is a block diagram showing as a voltage-up-down control circuit 200-1 the detailed configuration of the voltage-up-down control circuit 200-1 provided in the voltage-up-down power source circuit 20-1 shown in FIG. 1.

Please replace the paragraph beginning at page 6, line 22, with the following rewritten paragraph:

Referring to FIG. 2, a terminal T1 of the voltage-up-down control circuit 200-1 corresponds to the synchronous oscillation output terminal CLK of the voltage-up-down control circuit 200-1 shown in FIG. 1, and a terminal T3 corresponds to the fault terminal HLT of the voltage-up-down control circuit 200-1 shown in FIG. 1.

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Please replace the paragraph beginning at page 6, line 26, with the following rewritten paragraph:

The voltage-up control circuit 200-2, voltage-down control circuit 200-3, and voltage-down control circuit 200-4 shown in FIG. 1 also can be composed same as the voltage-up-down control circuit 200-1 shown in FIG. 2. In this case, the synchronous oscillation input terminals of the voltage-up control circuit 200-2, voltage-down control circuit 200-3, and voltage-down control circuit 200-4 shown in FIG. 1 will correspond to the terminal T2 of the voltage-up-down control circuit 200-1 shown in FIG. 2.

Please replace the paragraph beginning at page 7, line 1, with the following rewritten paragraph:

The voltage-up-down control circuit 200-1 shown in FIG. 2 is composed of an oscillator 201, a reference voltage generation circuit 202, an output voltage monitoring circuit 203, a drive circuit 204, and an output voltage abnormality detection circuit 205.

Please replace the paragraph beginning at page 7, line 4, with the following rewritten paragraph:

Basic operation of the voltage-up-down control circuit 200-1 involves controlling the drive circuit 204 according to the ~~oscillation signal generated by the oscillator 201 and outputting a~~

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~~switching signal for controlling the switching of the converter in the power source circuit where the voltage-up-down control circuit 200 is provided from terminal Tsw signal generated by the oscillator 201 and outputting a switching signal from terminal Tsw. The output switching signal controls the switching of the converter in the power source circuit in which the voltage-up-down control circuit 200-1 is located.~~

Please replace the paragraph beginning at page 7, line 12, with the following rewritten paragraph:

The reference voltage generation circuit 202 generates a reference voltage for ~~causing the operation of operating~~ the voltage-up-down control circuit 200-1, and the reference voltage generated from the reference voltage generation circuit 202 is applied to the oscillator 201, output voltage monitoring circuit 203, and output voltage abnormality detection circuit 205.

Please replace the paragraph beginning at page 7, line 17, with the following rewritten paragraph:

The output voltage monitoring circuit 203 monitors the output voltage of the power source circuit where the voltage-up-down control circuit 200-1 is provided, this voltage being inputted from a terminal Tm, and controls the drive circuit 204 so that this output voltage thereof is stably outputted at a desired level.

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Please replace the paragraph beginning at page 7, line 21, with the following rewritten paragraph:

The drive circuit 204 forms a switching signal for a converter located in the power source circuit provided with this voltage-up-down control circuit 200-1 based on the oscillation signal outputted from the oscillator 201 and the output of the output voltage monitoring circuit 203. The converter circuit will be described below in greater detail with reference to FIG. 3.

Please replace the paragraph bridging pages 7 and 8 (line 26, page 7 through line 2, page 8), with the following rewritten paragraph:

The output voltage abnormality detection circuit 205 detects the abnormality of the power source circuit where the voltage-up-down control circuit 200-1 is provided based on the output voltage of this power source circuit which is inputted from the terminal Tm. Furthermore, the output voltage abnormality detection circuit 205 detects abnormalities in other power source circuits based on the abnormality signals inputted from the terminal T3. When those abnormalities are detected, the abnormality signal is outputted from the terminal T3 and posted to other power source circuits, this abnormality signal is also outputted to the oscillator 201, oscillation of the oscillator 201 is stopped, and the voltage-up-down power source circuit 20-1 is shut down.

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Please replace the paragraph beginning at page 8, line 9, with the following rewritten paragraph:

Referring to FIG. 3, the circuit shown in FIG. 3(a) illustrates an example of a converter circuit in which the voltage can be stepped up and down and is provided, for example, in the voltage-up-down power source circuit 20-1 shown in FIG. 1. The converter circuit is composed of a capacitor C11 connected to an input terminal Tin, a switch element SW1, which is ~~switched by a switching signal outputted from a~~ triggered by the output signal at terminal Tsw of the voltage-up-down control circuit 200-1 shown in FIG. 2, a transformer TF having a coil L11 and a coil L12, a diode D1, and a capacitor C12 connected to an output terminal Tout.

Please replace the paragraph beginning at page 9, line 11, with the following rewritten paragraph:

Further, FIG. 3(d) illustrates an example of a converter circuit that can output a negative voltage. This converter circuit is composed of a capacitor C41 connected to the input terminal Tin, a switch element SW4 which is switched by a switching signal outputted from a terminal corresponding to the terminal Tsw of control circuit similar to the voltage-up-down control circuit 200-1 shown in FIG. 2, a coil L4, a diode D4, and a capacitor C42 connected to the output terminal Tout.

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Please replace the paragraph beginning at page 10, line 1, with the following rewritten paragraph:

Thus, the multiple output power source apparatus shown in FIG. 4 is composed, similarly to the multiple output power source apparatus shown in FIG. 1, for example, by connecting a voltage-up-down power source circuit (master) 30-1, a voltage-up power source circuit 30-2 (slave), a voltage-down power source circuit (slave) 30-3, and a voltage-down power source circuit [[20-4]] 30-4 in parallel to a power source 10 generating a voltage of 3.0V to 5.5 V. In this device, a voltage of 5.0 V is outputted from the voltage-up-down power source circuit 30-1, a voltage of 10 V is outputted from the voltage-up power source circuit 30-2, a power source voltage of 2.5 V is outputted from the voltage-down power source circuit 30-3, and a voltage of 1.8 V is outputted from the voltage-down power source circuit 30-4.

Please replace the paragraph beginning at page 12, line 12, with the following rewritten paragraph:

The voltage-up control circuit 300-2, voltage-down control circuit 300-3, and voltage-down control circuit 300-4 shown in FIG. 4 also can be composed same as the voltage-up-down control circuit 300-1 shown in FIG. 5. In this case, the synchronous oscillation input and fault terminals of the voltage-up control circuit 300-2, voltage-down control circuit 300-3, and voltage-down control circuit 300-4 shown in FIG. 4 will correspond to the terminal T22 of the circuit shown in FIG. 5.

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Please replace the paragraph beginning at page 12, line 18, with the following rewritten paragraph:

The voltage-up-down control circuit 300-1 shown in FIG. 5 has a basic configuration identical to that of the voltage-up-down control circuit 200-1 shown in FIG. 2, the difference therebetween being in that the fault terminal shown by [[he]] the terminal T3 in FIG. 2 is commonly used as the synchronous oscillation output terminal T1 and the synchronous oscillation input terminal T2.

Please replace the paragraph beginning at page 12, line 23, with the following rewritten paragraph:

Thus, the voltage-up-down control circuit 300-1 shown in FIG. 5 is composed of an oscillator 301, a reference voltage generation circuit 302, an output voltage monitoring circuit 303, a drive circuit 304, an output voltage abnormality detection circuit 305, and abnormality signal output switches 306 and 307.

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Please replace the paragraph beginning at page 12, line 27, with the following rewritten paragraph:

Here, the voltage-up-down control circuit 300-1 controls the drive circuit 304 according to the oscillation signal generated by the oscillator 301 and outputs a switching signal for controlling the switching of the converter in the power source circuit where the voltage-up-down control circuit 300-1 is provided from a terminal Tsw.

Please replace the paragraph beginning at page 13, line 1, with the following rewritten paragraph:

The reference voltage generation circuit 302 generates a reference voltage for causing the operation of the voltage-up-down control circuit 300-1, and the reference voltage generated from the reference voltage generation circuit 302 is applied to the oscillator 301, output voltage monitoring circuit 303, and output voltage abnormality detection circuit 305.

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Please replace the paragraph beginning at page 13, line 6, with the following rewritten paragraph:

The output voltage monitoring circuit 303 monitors the output voltage of the power source circuit where this voltage-up-down control circuit 300-1 is provided, this voltage being inputted from a terminal Tm, and controls the drive circuit [[204]] 304 so that this output voltage thereof is stably outputted at a desired level.

Please replace the paragraph beginning at page 13, line 10, with the following rewritten paragraph:

The drive circuit 304 forms a switching signal for a converter located in the power source circuit provided with this voltage-up-down control circuit 300-1 based on the oscillation signal outputted from the oscillator 301 and the output of the output voltage monitoring circuit 303. A circuit similar to that shown in FIG. 3 can be used as the converter circuit.

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Please replace the paragraph beginning at page 13, line 14, with the following rewritten paragraph:

The output voltage abnormality detection circuit 305 detects an abnormality of the power source circuit where the voltage-up-down control circuit 300-1 is provided based on the output voltage of this power source circuit which is inputted from the terminal Tm, and when the abnormality is detected, switches on the abnormality signal output switches 306 and 307. As a result, both the terminal T21 and the terminal T22 become at a ground level.

Please replace the paragraph beginning at page 15, line 1, with the following rewritten paragraph:

The output of the synchronous line monitor 350 and the output of the power source monitor 352 are connected to the OR element 354, and the output of the OR element 354 is connected to the mode switching switches 360, 362, 364. If an abnormality is detected in ~~any of the synchronous line monitor 350 and power source monitor 352 with such a configuration, the modes of the mode switching switches 360, 362, 364 are switched either the synchronous line monitor 350 or the power source monitor 352, the mode switches 360, 362, 364 are triggered, and the converter is deactivated.~~

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Please replace the paragraph bridging pages 15 and 16 (line 32, page 15 through line 7, page 16), with the following rewritten paragraph:

The control circuit 300-2 shown in FIG. 7 has a configuration similar to that of the control circuit 300-1 shown in FIG. 6, except for setting of the mode switching switch 362. Thus, with this configuration, in the power source circuit (slave) 30-2, the mode switching switch 362 is fixed to a terminal "1" side. As a result, the oscillator 301 is cut off from the synchronous line 320 and the drive circuit 304, regardless of whether the state is normal or abnormal, and the clock signal generated by the power source circuit (master) 30-1 is incorporated in the own circuit. With such a configuration, switching control of the power source circuit (slave) 30-2 is carried out in the form synchronized with the switching frequency of the power source circuit (master) 30-1.

Please replace the paragraph bridging pages 16 and 17 (line 29, page 16 through line 2, page 17), with the following rewritten paragraph:

FIG. 9 is a block diagram illustrating a configuration example of the synchronous line 350 monitor shown in FIG. 6, FIG. 7, and FIG. 8. The synchronous line monitor 350 shown in the figure is composed of an inversion element 370, a counter 372, a decoder 374, and an OR element 376. A signal from the synchronization and fault terminal CLK&HLT is inputted in a set terminal of the

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counter 372 via the inversion element 370 and, at the same time, a signal from the synchronization and fault terminal CLK&HLT is inputted in the reset terminal of the counter 372.

Please replace the paragraph beginning at page 17, line 3, with the following rewritten paragraph:

FIG. 10 is a timing chart illustrating the operation of the synchronous line monitor shown in FIG. 9. A signal denoted by “CLK” in the figure shows the state of a clock signal generated by the oscillator 301 of the power source circuit (master) 30-1, a signal denoted by “CLK&HLT” shows the state of a clock signal flowing in the synchronous line 320, a signal denoted by “a” shows a period in which the counter 372 shown in FIG. 9 conducts counting, and a signal denoted by “b” shows the state of a signal outputted by the decoder 37 374 shown in FIG. 9.